

PATENT ABSTRACTS OF JAPAN

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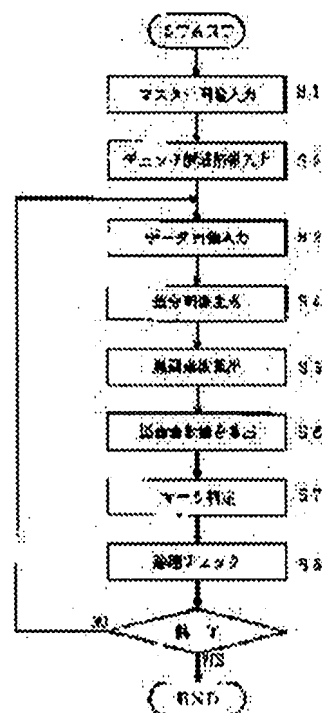
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(54) METHOD AND DEVICE FOR RECOGNIZING MARK AND RECORDING MEDIUM

(57)Abstract:

PROBLEM TO BE SOLVED: To recognize a mark on the sheet of a questionnaire to surround a selected item with a circle mark or to describe a check mark on the selected item by printing selection items on a plain paper.

SOLUTION: An image on the surface of paper, where no mark is described, and an image on the surface of paper, where any mark is described, are inputted (S1 and S3) and a check area on the surface of paper is designated (S2). Then, the differential image of two inputted images is generated (S4) and the number of black pixels and the ratio of black pixels on the differential image are found for each check area (S5 and S6). Based on the number of black pixels and the ratio of black pixel, the presence/absence of the mark in each check area is decided (S7).



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decision of rejection]

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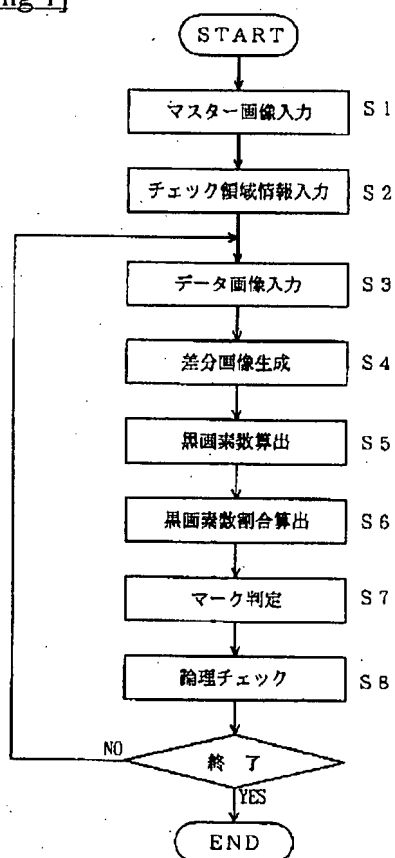
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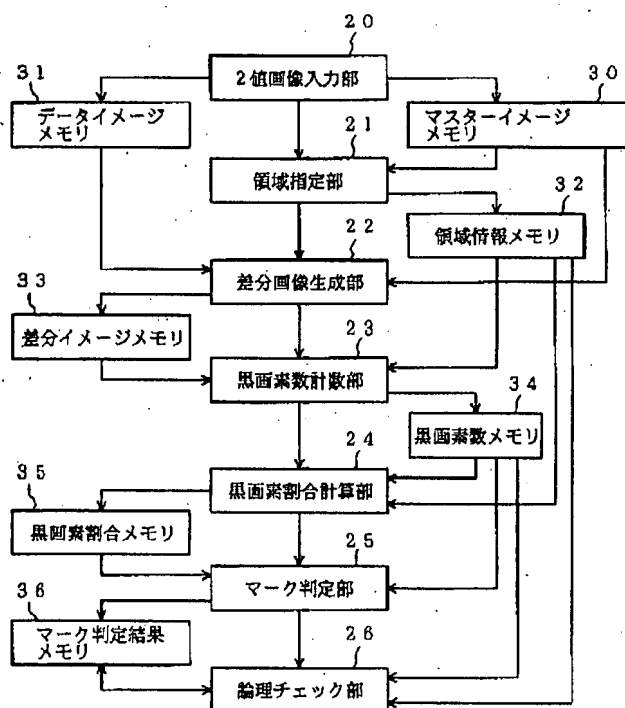
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DRAWINGS

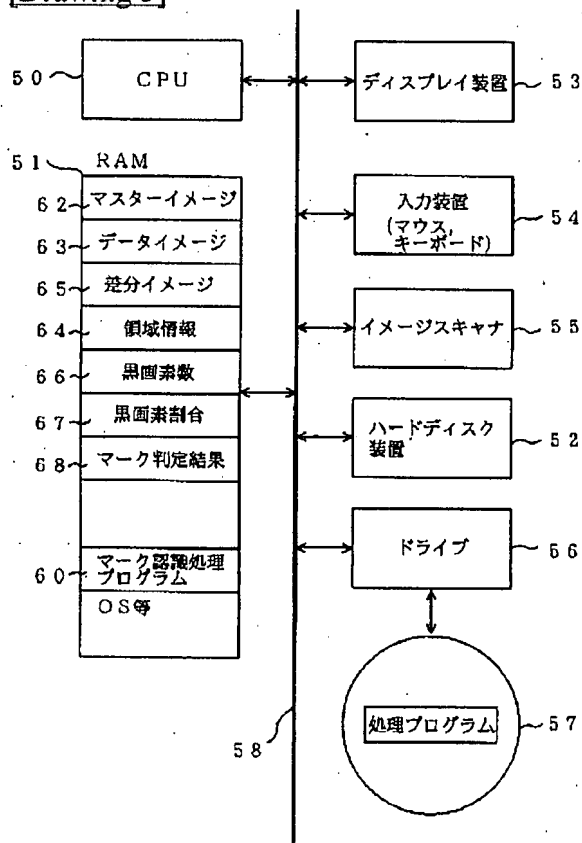
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Drawing 4]

質問票 100

この講習を受講された感想は?

1. とても良い	2. まあまあ良い	3. 普通
4. あまり良くない	5. とても悪い	

チェック領域

質問票 101

この講習を受講された感想は?

1. とても良い	2. まあまあ良い	3. 普通
4. あまり良くない	5. とても悪い	

M

質問票 102

c1	c2	c3
c4	c5	

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a mark recognition technique.

[0002]

[Description of the Prior Art] A check mark is made to fill in with a pencil etc. in the mark preprinted guide line set up beforehand in the field of mark recognition conventionally using the special form called an OMR sheet in many cases. With such mark recognition equipment of an OMR sheet, when an OMR sheet is read optically and the segment of fixed die length and a size is generally detected in a mark preprinted guide line, it has judged with the mark being entered in the mark preprinted guide line.

[0003] Moreover, apart from the usual mark preprinted guide line, prepare the mark block for reference in the head of an OMR sheet, make the entry person enter two or more marks in the mark block for reference, and it sets to mark recognition equipment. Size c of the segment which detected an average of a and deflection b of the size of the segment written down in the block for reference of an OMR sheet, and was detected in the mark preprinted guide line at the time of $c \geq a - b$. The mark recognition approach judged as the mark being entered in the mark preprinted guide line is also proposed (JP,6-333066,A).

[0004]

[Problem(s) to be Solved by the Invention] For example, if mark recognition can be used when taking the questionnaire of assessment to goods, service, etc., the total of a questionnaire result etc. can be performed efficiently. However, if a questionnaire is created using an OMR sheet, the most costs and time amount will be taken, and also there is a problem that it tends to become a psychological barrier for a respondent to enter a mark in the limited check frame.

[0005] In order to avoid such a problem, it is desirable that the questionnaire of a format which selections are printed in a regular paper, and makes selections surround by the round-head mark, or makes a check mark attached on selections can be used. However, in such a questionnaire, since the filled-in mark laps with the printer graphic of selections or dispersion, such as an entry location of a mark, and a configuration, magnitude, is large, with the conventional mark recognition technique on condition of a mark being filled in in the mark preprinted guide line on the above OMR sheets, exact mark recognition is not expectable.

[0006] Therefore, the object of this invention is to offer the suitable mark recognition approach and the equipment for the mark recognition over a document like a questionnaire with which only selections were printed by the regular paper.

[0007]

[Means for Solving the Problem] In order to attain said object, in the mark recognition approach of this invention, the image of the document in which the image and mark of a document with an unentered mark were entered is inputted, and the subtraction image is generated from two inputted images, and the check field of a document is specified. A check field is a field like the range surrounding the selections in the questionnaire of a regular paper as which a mark may be filled in, and is not a limited field like the mark preprinted guide line of an OMR sheet. And for each [which was specified] check field of

- every, the number of black pixels and black pixel rate on the generated subtraction image are measured, and the existence of the mark in each check field is judged based on the number of black pixels and black pixel rate which were measured. For example, when the number of black pixels is more than the 1st predetermined number, and when the number of black pixels is more than the 2nd predetermined number and a black pixel rate is more than the 3rd predetermined rate, it is judged with there being a mark. Moreover, in order to cope with the mark entry overlapped in case mark entry was made alternatively, a logic check is performed to the result of a mark existence judging.

[0008] Moreover, a means by which the mark recognition equipment of this invention inputs the image of a document with an unentered mark, A means to input the image of the document in which the mark was entered, a means to generate the subtraction image from two inputted images, A means to measure the number of black pixels and black pixel rate on the generated subtraction image for every means to specify the check field of a document, and each [which was specified] check field, It considers as the configuration possessing a means to judge the existence of a mark [in each check field] based on the number of black pixels and black pixel rate which were measured, and a means to perform a logic check to the judgment result of the existence of a mark further.

[0009]

[Embodiment of the Invention] Hereafter, the mark recognition system using a computer is explained as the mark recognition approach of this invention, and 1 operation gestalt of equipment. A functional block configuration is shown in drawing 2, and a hardware configuration is shown for the flow of mark recognition processing of this mark recognition system in drawing 1 at drawing 3, respectively. In addition, the mark recognition equipment of this invention can also be included in other information management systems, such as a character reader and a copying machine.

[0010] The hardware configuration shown in drawing 3 is common as a computer. In drawing 3, for a hard disk drive unit and 53, as for input devices, such as pointing devices, such as a mouse, and a keyboard, and 55, a display unit and 54 are [RAM for which CPU and 51 are used for 50 as a work area, and the program and data storage region of CPU50 and 52 / an image scanner and 56] the drives for R/W of portable record media, such as a floppy disk and CD-ROM, and each [these] element is mutually connected through a system bus 58.

[0011] The mark (or in order to realize function of functional block 20-26 shown in drawing 2) recognition processing program 60 for performing mark recognition procedure which consists of step S1 shown in drawing 1 - S9 on the hardware of this computer is put on RAM60, and is executed by CPU50. The mark recognition processing program 60 is read by drive 56 from the portable record medium 57, is directly loaded to RAM51, or is once stored in a hard disk drive unit 52, and is loaded to RAM51 from a hard disk drive unit 52 at the time of activation. The specific fields 62-68 of RAM51 are assigned as various memory 30-36 in drawing 2. Control programs, such as an operating system, etc. are loaded to RAM51 from a hard disk drive unit 52.

[0012] The content of processing and configuration of a mark recognition system are explained referring to drawing 3 if needed and mainly referring to drawing 1 and drawing 2 hereafter.

[0013] In step S1, the binary image input section 20 inputs the master image (binary image of a document with an unentered mark) of the document set as the object of mark recognition, and stores it in the master image memory 30. The image which read the mark non-entered document and was read is specifically stored in the master image memory 30 with an image scanner 55, or it is read beforehand, and the master image stored in the hard disk drive unit 52 is read into the master image memory 30. In drawing 4, 100 is an example of a master image.

[0014] Next, in step S2, the block-definition section 21 inputs the information which specifies the check field of a document, and stores the check field information in the field information memory 32. Here, check fields will be the field as which a mark may be filled in, and a field which investigates the existence of a mark, if it puts in another way, for example, in the case of a questionnaire which surrounds selections by the round mark, they are a field surrounding each selections, or a field surrounding some selections. By the master image 100 of drawing 4, the field shown, for example with the broken line is specified as a check field. Assignment of this check field can display for example, a

master image on the screen of a display unit 53, and can be performed by the approach that the mouse of an input device 54 etc. is operated and the corner location of a check field is directed on a screen. Moreover, a check block definition can also be performed by specifying the class of document and reading the check field information into the field information memory 32 by the case where the document of the same class as the document which had already processed is treated, when the information on the check field is saved as a file at the hard disk drive unit 52.

[0015] In the following step S3, by the binary image input section 20, the data image (binary image of a document [finishing / entry of a mark]) of the document of the same class is inputted, and it stores in the data image memory 31. The document in which the mark was entered with the image scanner 55 is read, and, specifically, the data image which stores the read image in the data image memory 31, or is read beforehand and stored in the hard disk drive unit 52 is read into the data image memory 31. In drawing 4, 101 is an example of a data image. the data image 101 -- selections -- "2. -- it is easy to be so so --" -- it is the same image as the master image 100 except Mark M being entered in the part.

[0016] the following step S4 -- setting -- the subtraction-image generation section 22 -- the master image on the master image memory 30, and the data image on the data image memory 31 to the subtraction image -- generating -- it -- difference -- it stores in image memory 33. A subtraction image is generated by specifically taking the exclusive OR of both images, after correcting a location gap of a master image and a data image. In drawing 4, 102 is the subtraction image of the master image 100 and the data image 101, and it turns out that the mark M entered in the document was extracted. In addition, although the field shown with the broken line in a subtraction image 102 expresses the check fields c1-c5, it does not exist actually in a subtraction image. Moreover, the black pixel (noise) resulting from the error of location gap correction of an image, the dirt of a document, etc. may be contained in a subtraction image.

[0017] the following step S5 -- setting -- the number of black pixels -- counting -- the number of black pixels which carried out counting of the number of black pixels on a subtraction image, and asked for it for every check field with reference to a subtraction image and field information by the section 23 is stored in the number memory 34 of black pixels. the black pixel rate for which calculated the area (the total number of pixels) of each check field with reference to field information and the number of black pixels based on field information, and asked for the black pixel rate of each check field by the black pixel rate count section 24 by carrying out division process of the number of black pixels in the area of each check field, and it asked in the following step S6 -- ***** -- a note is made comparatively and it stores in 35.

[0018] In the following step S7, by the mark judging section 25, with reference to a black pixel rate and the number of black pixels, the existence of a mark is judged for every check field, a note of the result is made as a result of a mark judging, and it stores in 36. The rule of this judgment is judged to be those with a mark, "black pixel rates being one or more predetermined values Th" or when "the numbers of black pixels are two or more predetermined values Th and black pixel rates are three or more predetermined values Th." Although it is dependent on the class (it is related to the size of a mark entry line etc.) of check area size and writing implement used for mark entry etc., the above-mentioned predetermined value will be chosen as 1= 3% of Th, Th 2= 10, and 3= 1% of Th if an example is given. According to the mark judging approach using such a number of black pixels, and a black pixel rate, the mark existence judging which cannot be easily influenced of the noise contained in dispersion in filled-in the die length, size, and configuration of a mark, the crossover with a mark and a printer graphic, and a subtraction image is possible. Thus, in the subtraction image 102 of drawing 4, only the check field c2 is judged to be those with mark entry.

[0019] The following step S8 is a required step, when aimed at the document in which a mark is entered alternatively, or only when being aimed at the document with which the check field as which a mark is filled in alternatively is included. For example, in the example of the document shown in drawing 4, since it is the example as which a mark is entered only in one of the five check fields, this step S8 is needed. In this step S8, when two or more of two or more check fields as which a mark should be alternatively filled in with reference to a mark judging result in the logic check section 26 are judged to

- be those with a mark, it is judged as a logic error. When it is judged as a logic error, the processing which corrects a mark judging result so that the mutual comparison of the number of black pixels of two or more check fields judged to be those with a mark may be carried out and the number of black pixels may make only the greatest check field those with a mark, or repeals the mark judging result about the specific check field relevant to all the mark judging results or the logic error of the document carries out. Although it is erased with a rubber although the mark was attached to a certain selections with the pencil, and the mark was reattached to another selections, when how to erase the mark filled in previously is inadequate, the mark may also be recognized as an effective thing. In such a case, since possibility fewer than the number of black pixels of the mark attached later is high, the number of black pixels of the mark erased to imperfection has effective correction processing of a mark recognition result which was described above in many cases.

[0020] When performing continuously mark recognition of a document of the same kind, processing of step S1 - step S8 is performed repeatedly, mark recognition processing is completed in the phase whose document which should be processed next was lost, and the mark recognition result of each document makes a note as a result of a mark judging, and is obtained by 36.

[0021]

[Effect of the Invention] According to this invention, selections are printed in a regular paper and the mark recognition over documents of various formats, such as a questionnaire which makes the mark surrounding selections fill in or makes a check mark fill in on selections, is attained so that clearly from the above explanation.

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] The step into which a mark inputs the image of an unentered document, and the step which inputs the image of the document in which the mark was entered, The step which generates the subtraction image from two inputted images, and the step which specifies the check field of a document, The mark recognition approach of having the step which measures the number of black pixels and black pixel rate on the generated subtraction image for each [which was specified] check field of every, and the step which judges the existence of the mark in each check field based on the number of black pixels and black pixel rate which were measured.

[Claim 2] The mark recognition approach which carries out the description of judging with there being a mark in the mark recognition approach according to claim 1 at the step which judges the existence of a mark when the number of black pixels is beyond the 1st predetermined value, and when the number of black pixels is beyond the 2nd predetermined value and a black pixel rate is beyond the 3rd predetermined value.

[Claim 3] The mark recognition approach according to claim 1 or 2 characterized by having the step which performs a logic check to the judgment result of the existence of a mark.

[Claim 4] A means by which a mark inputs the image of an unentered document, and a means to input the image of the document in which the mark was entered, A means to generate the subtraction image from two inputted images, and a means to specify the check field of a document, Mark recognition equipment characterized by providing a means to measure the number of black pixels and black pixel rate on the generated subtraction image, and a means to judge the existence of a mark [in each check field] based on the number of black pixels and black pixel rate which were measured, for each [which was specified] check field of every.

[Claim 5] Mark recognition equipment according to claim 4 characterized by having a means to perform a logic check to the judgment result of the existence of a mark.

[Claim 6] The record medium which carries out the description of the program for making a computer perform processing of each step of the mark recognition approach according to claim 1, 2, or 3 having been recorded and in which computer reading is possible.

[Translation done.]